

## Radiation Stability of Nanostructured Yttrium Stabilized Zirconia

Santanu Ghosh

Indian Institute of Technology Delhi, India

### Abstract

Radiation damage in materials is strongly influenced by specific energy loss (electronic energy loss (Se) and/or nuclear energy loss (Sn)), material microstructure (grain size) and environmental (irradiation) temperature. For a systematic understanding of the dependence of radiation tolerance on these factors, yttria stabilized zirconia (YSZ) with different grain sizes (tens of nano-meters to few microns) were irradiated under different conditions (single beam irradiation with high energy (Se>>Sn) ions at 300K and 1000K, single beam irradiation with low energy (Sn>>Se) ions at 300K & simultaneous dual beam irradiation with high and low energies at 300K). The low and high energy ions were chosen to mimic the damage produced by alpha recoils and fission fragments respectively, and thus the irradiations at 1000K and the dual beam irradiations helped to better simulate typical nuclear reactor environment. For the high energy (single beam) irradiations, (i) the nano-crystalline samples were more damaged compared to the micro-crystalline sample irrespective of the irradiation temperature and (ii) the damage for all grain sizes was found to be reduced at 1000K compared to that at 300K. Interestingly, this damage reduction was significantly more for the nano-crystalline samples as compared to the microcrystalline one. Results are explained in the framework of thermal spike model.



### Biography:

Santanu Ghosh has long expertise in the area of radiation stability of ceramic oxides and ion materials interaction. He is PI of 5 international project, which include one prestigious CRP funded by IAEA, UNO. He is also PI of 7 national project. He has delivered 40 invited talks, published two books, 6 book chapters and 87 paper in peer reviewed journals. He has presently developed prototypes of CNT based field emission microscope and x-ray sources. One of this is filed as patent.

### Speaker Publications:

1. Kalita, Parswajit & Ghosh, Santanu & Singh, Udai & Kulriya, Pawan Kumar & Grover, V. & Shukla, Rakesh & Tyagi, A. & Sattonnay, G. & Avasthi, Devesh. (2019). Investigating the effect of material microstructure and irradiation temperature on the radiation tolerance of yttria stabilized zirconia against high energy heavy ions. *Journal of Applied Physics*. 125. 115902. 10.1063/1.5080934.
2. Kalita, Parswajit & Shukla, Rakesh & GHOSH, SANTANU & Srivastava, Sanjeev & Pathak, Nimai & Kulriya, Pawan Kumar & Grover, V. & Avasthi, Devesh & Tyagi, Avesh. (2020). Insights into the Effect of Particle Size on the Low Energy Radiation Response of Ceria. *The Journal of Physical Chemistry C*. XXXX. 10.1021/acs.jpcc.0c02907.
3. Singh, Preetam & Ghosh, Santanu & Singh, Arvind & Kumar, Sunil & Ojha, Sunil & Srivastava, Pankaj. (2020). Defect mediated modification of structural, optical and magnetic properties of Xe<sup>3+</sup> ions irradiated GaN/sapphire films. *Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms*. 466.61-68. 10.1016/j.nimb.2020.01.015.



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